

# LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V, LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV QUADRUPLE OPERATIONAL AMPLIFIERS

查询"LM124M"供应商

SLOS066T – SEPTEMBER 1975 – REVISED MARCH 2010

- 2-kV ESD Protection for:
  - LM224K, LM224KA
  - LM324K, LM324KA
  - LM2902K, LM2902KV, LM2902KAV
- Wide Supply Ranges
  - Single Supply . . . 3 V to 32 V  
(26 V for LM2902)
  - Dual Supplies . . .  $\pm 1.5$  V to  $\pm 16$  V  
( $\pm 13$  V for LM2902)
- Low Supply-Current Drain Independent of Supply Voltage . . . 0.8 mA Typ
- Common-Mode Input Voltage Range Includes Ground, Allowing Direct Sensing Near Ground
- Low Input Bias and Offset Parameters
  - Input Offset Voltage . . . 3 mV Typ  
A Versions . . . 2 mV Typ
  - Input Offset Current . . . 2 nA Typ
  - Input Bias Current . . . 20 nA Typ  
A Versions . . . 15 nA Typ
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . . 32 V  
(26 V for LM2902)
- Open-Loop Differential Voltage Amplification . . . 100 V/mV Typ
- Internal Frequency Compensation

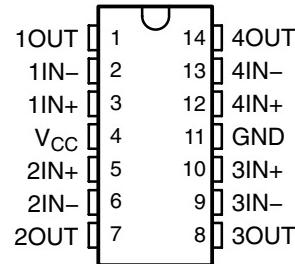
## description/ordering information

These devices consist of four independent high-gain frequency-compensated operational amplifiers that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3 V to 32 V (3 V to 26 V for the LM2902), and  $V_{CC}$  is at least 1.5 V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

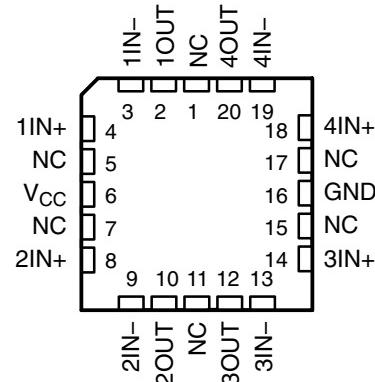
Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational-amplifier circuits that now can be more easily implemented in single-supply-voltage systems. For example, the LM124 can be operated directly from the standard 5-V supply that is used in digital systems and provides the required interface electronics, without requiring additional  $\pm 15$ -V supplies.

LM124 . . . D, J, OR W PACKAGE
LM124A . . . J OR W PACKAGE
LM224, LM224A, LM224K, LM224KA . . . D OR N PACKAGE
LM324, LM324K . . . D, N, NS, OR PW PACKAGE
LM324A . . . D, DB, N, NS, OR PW PACKAGE
LM324KA . . . D, N, NS, OR PW PACKAGE
LM2902 . . . D, N, NS, OR PW PACKAGE
LM2902K . . . D, DB, N, NS, OR PW PACKAGE
LM2902KV, LM2902KAV . . . D OR PW PACKAGE

(TOP VIEW)



LM124, LM124A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

SLOS45G11SERIAL NUMBER 1951 RELEASED MARCH 2010

藍海 M124M 模擬商

**ORDERING INFORMATION<sup>†</sup>**

T <sub>A</sub>	V <sub>I0</sub> max AT 25°C	MAX TESTED V <sub>CC</sub>	PACKAGE <sup>‡</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING	
0°C to 70°C	7 mV	30 V	PDIP (N)	Tube of 25	LM324N	
				LM324KN	LM324KN	
			SOIC (D)	Tube of 50	LM324D	
				Reel of 2500	LM324DR	
				Reel of 2500	LM324DRG3	
				Tube of 50	LM324KD	
				Reel of 2500	LM324KDR	
			SOP (NS)	Reel of 2000	LM324NSR	
	3 mV	30 V		Tube of 50	LM324KNS	
				Reel of 2000	LM324KNSR	
		TSSOP (PW)	Tube of 90	LM324PW		
			Reel of 2000	LM324PWR		
			Tube of 90	LM324KPW		
			Reel of 2000	LM324KPWR		
		PDIP (N)	Tube of 25	LM324AN		
			Tube of 25	LM324KAN		
-25°C to 85°C	5 mV	30 V	SOIC (D)	Tube of 50	LM324AD	
				Reel of 2500	LM324ADR	
			SOP (NS)	Tube of 50	LM324KAD	
				Reel of 2500	LM324KADR	
			SSOP (DB)	Reel of 2000	LM324ANSR	
				Tube of 50	LM324KANS	
	3 mV	30 V	TSSOP (PW)	Reel of 2000	LM324KANSR	
				Reel of 2000	LM324ADBR	
				Tube of 90	LM324APW	
				Reel of 2000	LM324APWR	
			PDIP (N)	Tube of 90	LM324KAPW	
				Reel of 2000	LM324KAPWR	
			SOIC (D)	Tube of 25	LM224N	
				Tube of 25	LM224KN	
	5 mV	30 V	SOIC (D)	Tube of 50	LM224D	
				Reel of 2500	LM224DR	
			SOP (NS)	Tube of 50	LM224KD	
				Reel of 2500	LM224KDR	
			SOIC (D)	Tube of 25	LM224AN	
	3 mV	30 V		Tube of 25	LM224KAN	
				Tube of 50	LM224AD	
				Reel of 2500	LM224ADR	
				Tube of 50	LM224KAD	
				Reel of 2500	LM224KADR	

<sup>†</sup> For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

<sup>‡</sup> Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).



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**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

[查询"LM124M"供应商](#)

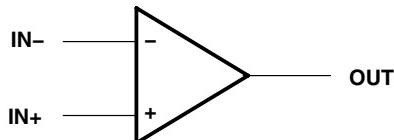
SLOS066T – SEPTEMBER 1975 – REVISED MARCH 2010

**ORDERING INFORMATION (CONTINUED)**

T <sub>A</sub>	V <sub>IO</sub> <sup>max</sup> AT 25°C	MAX TESTED V <sub>CC</sub>	PACKAGE <sup>†</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	7 mV	26 V	PDIP (N)	Tube of 25	LM2902N
				Tube of 25	LM2902KN
			SOIC (D)	Tube of 50	LM2902D
				Reel of 2500	LM2902DR
				Tube of 50	LM2902KD
				Reel of 2500	LM2902KDR
			SOP (NS)	Reel of 2000	LM2902NSR
				Tube of 50	LM2902KNS
				Reel of 2000	LM2902KNSR
			SSOP (DB)	Tube of 80	LM2902KDB
				Reel of 2000	LM2902KDBR
			TSSOP (PW)	Tube of 90	LM2902PW
				Reel of 2000	LM2902PWR
				Tube of 90	LM2902KPW
				Reel of 2000	LM2902KPWR
		32 V	SOIC (D)	Reel of 2500	LM2902KVQDR
			TSSOP (PW)	Reel of 2000	LM2902KVQPWR
	2 mV	32 V	SOIC (D)	Reel of 2500	LM2902KAVQDR
			TSSOP (PW)	Reel of 2000	LM2902KAVQPWR
					L2902KA
-55°C to 125°C	5 mV	30 V	CDIP (J)	Tube of 25	LM124J
			CFP (W)	Tube of 25	LM124W
			LCCC (FK)	Tube of 55	LM124FK
			SOIC (D)	Tube of 50	LM124D
				Reel of 2500	LM124DR
	2 mV	30 V	CDIP (J)	Tube of 25	LM124AJ
			CFP (W)	Tube of 25	LM124AW
			LCCC (FK)	Tube of 55	LM124AFK

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

**symbol (each amplifier)**

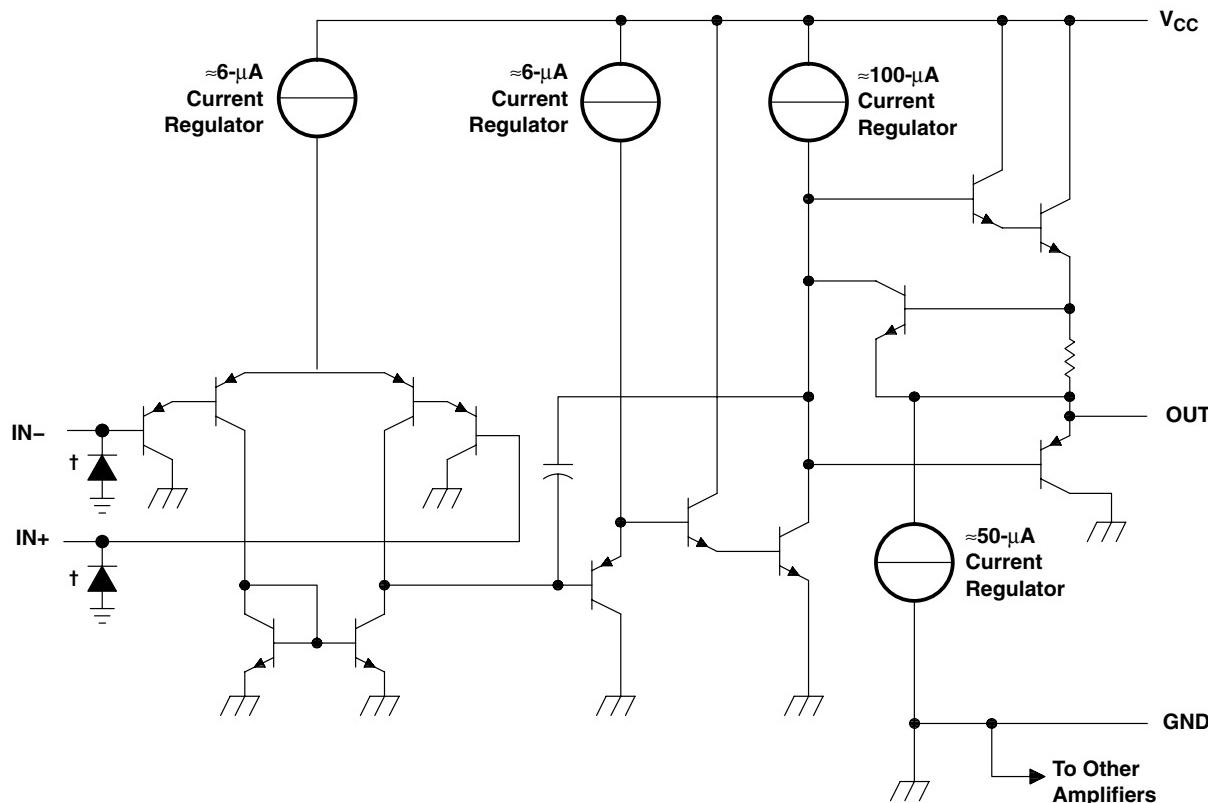


**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

SLOS0011, ISSUE EDITION 195, REvised MARCH 2010

貴公司 LM124M 模擬商

schematic (each amplifier)



COMPONENT COUNT (total device)	
Epi-FET	1
Transistors	95
Diodes	4
Resistors	11
Capacitors	4

† ESD protection cells - available on LM324K and LM324KA only

**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

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SLOS066T – SEPTEMBER 1975 – REVISED MARCH 2010

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

	LM2902	ALL OTHER DEVICES	UNIT
Supply voltage, $V_{CC}$ (see Note 1)	±13 or 26	±16 or 32	V
Differential input voltage, $V_{ID}$ (see Note 2)	±26	±32	V
Input voltage, $V_I$ (either input)	-0.3 to 26	-0.3 to 32	V
Duration of output short circuit (one amplifier) to ground at (or below) $T_A = 25^\circ\text{C}$ , $V_{CC} \leq 15$ V (see Note 3)	Unlimited	Unlimited	
Package thermal impedance, $\theta_{JA}$ (see Notes 4 and 5)	D package	86	86
	DB package	96	96
	N package	80	80
	NS package	76	76
	PW package	113	113
Package thermal impedance, $\theta_{JC}$ (see Notes 6 and 7)	FK package		5.61
	J package		15.05
	W package		14.65
Operating virtual junction temperature, $T_J$	150	150	°C
Case temperature for 60 seconds	FK package		260
Lead temperature 1.6 mm (1/16 inch) from case for 60 seconds	J or W package	300	300
Storage temperature range, $T_{stg}$	-65 to 150	-65 to 150	°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values (except differential voltages and  $V_{CC}$  specified for the measurement of  $I_{OS}$ ) are with respect to the network GND.
  2. Differential voltages are at IN+, with respect to IN-.
  3. Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.
  4. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  5. The package thermal impedance is calculated in accordance with JESD 51-7.
  6. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(\text{max}) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  7. The package thermal impedance is calculated in accordance with MIL-STD-883.

### ESD protection

TEST CONDITIONS		TYP	UNIT
Human-Body Model	LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV	±2	kV



**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

SLOS201C/DSN-195 - REVISED MARCH 2010

電荷傳感器 LM124 廣泛應用

electrical characteristics at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>†</sup>	$T_A^{\ddagger}$	LM124 LM224			LM324 LM324K			UNIT	
			MIN	TYP <sup>§</sup>	MAX	MIN	TYP <sup>§</sup>	MAX		
$V_{IO}$	Input offset voltage $V_{CC} = 5\text{ V}$ to MAX, $V_{IC} = V_{ICRmin}$ , $V_O = 1.4\text{ V}$	25°C		3	5		3	7	mV	
		Full range			7			9		
$I_{IO}$	Input offset current $V_O = 1.4\text{ V}$	25°C		2	30		2	50	nA	
		Full range			100			150		
$I_{IB}$	Input bias current $V_O = 1.4\text{ V}$	25°C		-20	-150		-20	-250	nA	
		Full range			-300			-500		
$V_{ICR}$	Common-mode input voltage range $V_{CC} = 5\text{ V}$ to MAX	25°C	0 to $V_{CC} - 1.5$			0 to $V_{CC} - 1.5$			V	
		Full range	0 to $V_{CC} - 2$			0 to $V_{CC} - 2$				
$V_{OH}$	$R_L = 2\text{ k}\Omega$	25°C	$V_{CC} - 1.5$			$V_{CC} - 1.5$			V	
	$R_L = 10\text{ k}\Omega$	25°C								
	$V_{CC} = \text{MAX}$	$R_L = 2\text{ k}\Omega$	Full range	26		26				
		$R_L \geq 10\text{ k}\Omega$	Full range	27	28	27	28			
$V_{OL}$	Low-level output voltage $R_L \leq 10\text{ k}\Omega$	Full range		5	20		5	20	mV	
$A_{VD}$	Large-signal differential voltage amplification $V_{CC} = 15\text{ V}$ , $V_O = 1\text{ V}$ to $11\text{ V}$ , $R_L \geq 2\text{ k}\Omega$	25°C	50	100		25	100		V/mV	
		Full range	25			15				
CMRR	Common-mode rejection ratio $V_{IC} = V_{ICRmin}$	25°C	70	80		65	80		dB	
$k_{SVR}$	Supply-voltage rejection ratio ( $\Delta V_{CC}/\Delta V_{IO}$ )	25°C	65	100		65	100		dB	
$V_{O1}/V_{O2}$	Crosstalk attenuation $f = 1\text{ kHz}$ to $20\text{ kHz}$	25°C		120			120		dB	
$I_O$	Output current $V_{CC} = 15\text{ V}$ , $V_{ID} = 1\text{ V}$ , $V_O = 0$	25°C	-20	-30	-60	-20	-30	-60	mA	
		Full range	-10			-10				
		25°C	10	20		10	20			
		Full range	5			5				
$I_{OS}$	Short-circuit output current $V_{CC} \text{ at } 5\text{ V}$ , GND at $-5\text{ V}$	$V_O = 200\text{ mV}$	25°C	12	30	12	30		$\mu\text{A}$	
$I_{CC}$	Supply current (four amplifiers) $V_O = 2.5\text{ V}$ , No load	Full range	0.7	1.2		0.7	1.2		mA	
		$V_{CC} = \text{MAX}$ , $V_O = 0.5\text{ V}_{CC}$ , No load	Full range	1.4	3	1.4	3			

<sup>†</sup> All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is 26 V for LM2902 and 30 V for the others.

<sup>‡</sup> Full range is  $-55^\circ\text{C}$  to  $125^\circ\text{C}$  for LM124,  $-25^\circ\text{C}$  to  $85^\circ\text{C}$  for LM224, and  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for LM324.

<sup>§</sup> All typical values are at  $T_A = 25^\circ\text{C}$ .



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**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

查询"LM124M"供应商

SLOS066T – SEPTEMBER 1975 – REVISED MARCH 2010

**electrical characteristics at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS <sup>†</sup>	$T_A^{\ddagger}$	LM2902			LM2902V			UNIT
			MIN	TYP <sup>§</sup>	MAX	MIN	TYP <sup>§</sup>	MAX	
$V_{IO}$	Input offset voltage  $V_{CC} = 5\text{ V}$ to MAX, $V_{IC} = V_{ICR\min}$ , $V_O = 1.4\text{ V}$	25°C		3	7		3	7	mV
		Full range			10			10	
		A-suffix devices	25°C				1	2	
		Full range						4	
$\Delta V_{IO}/\Delta T$	Input offset voltage temperature drift  $R_S = 0\ \Omega$	Full range						7	$\mu\text{V}/^{\circ}\text{C}$
$I_{IO}$	Input offset current  $V_O = 1.4\text{ V}$	25°C		2	50		2	50	nA
		Full range			300			150	
$\Delta I_{IO}/\Delta T$	Input offset current temperature drift	Full range						10	$\text{pA}/^{\circ}\text{C}$
$I_{IB}$	Input bias current  $V_O = 1.4\text{ V}$	25°C		-20	-250		-20	-250	nA
		Full range			-500			-500	
$V_{ICR}$	Common-mode input voltage range  $V_{CC} = 5\text{ V}$ to MAX	25°C	0 to $V_{CC} - 1.5$			0 to $V_{CC} - 1.5$			V
		Full range	0 to $V_{CC} - 2$			0 to $V_{CC} - 2$			
$V_{OH}$	High-level output voltage  $R_L = 2\text{ k}\Omega$  $R_L = 10\text{ k}\Omega$  $V_{CC} = \text{MAX}$	25°C							V
		25°C							
		$R_L = 2\text{ k}\Omega$	Full range	22			26		
		$R_L \geq 10\text{ k}\Omega$	Full range	23	24		27		
$V_{OL}$	Low-level output voltage  $R_L \leq 10\text{ k}\Omega$	Full range		5	20		5	20	mV
$A_{VD}$	Large-signal differential voltage amplification  $V_{CC} = 15\text{ V}$ , $V_O = 1\text{ V}$ to $11\text{ V}$ , $R_L \geq 2\text{ k}\Omega$	25°C	25	100		25	100		V/mV
		Full range	15			15			
CMRR	Common-mode rejection ratio  $V_{IC} = V_{ICR\min}$	25°C	50	80		60	80		dB
$k_{SVR}$	Supply-voltage rejection ratio $(\Delta V_{CC}/\Delta V_{IO})$	25°C	50	100		60	100		dB
$V_{O1}/V_{O2}$	Crosstalk attenuation  $f = 1\text{ kHz}$ to $20\text{ kHz}$	25°C		120			120		dB
$I_O$	Output current  $V_{CC} = 15\text{ V}$ , $V_{ID} = 1\text{ V}$ , $V_O = 0$  $V_{CC} = 15\text{ V}$ , $V_{ID} = -1\text{ V}$ , $V_O = 15\text{ V}$  $V_{ID} = -1\text{ V}$ , $V_O = 200\text{ mV}$	25°C	-20	-30	-60	-20	-30	-60	mA
		Full range	-10			-10			
		25°C	10	20		10	20		
		Full range	5			5			
$I_{OS}$	Short-circuit output current  $V_{CC} = 5\text{ V}$ , $GND$ at $-5\text{ V}$	25°C		30		12	40		$\mu\text{A}$
$I_{CC}$	Supply current (four amplifiers)  $V_O = 2.5\text{ V}$ , No load	Full range		0.7	1.2		0.7	1.2	mA
		$V_{CC} = \text{MAX}$ , $V_O = 0.5 V_{CC}$ , No load	Full range	1.4	3		1.4	3	

<sup>†</sup> All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified. MAX  $V_{CC}$  for testing purposes is  $26\text{ V}$  for LM2902 and  $32\text{ V}$  for LM2902V.

<sup>‡</sup> Full range is  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  for LM2902.

<sup>§</sup> All typical values are at  $T_A = 25^{\circ}\text{C}$ .

[查询"LM124M"供应商](#)

8

**electrical characteristics at specified free-air temperature,  $V_{CC} = 5\text{ V}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS <sup>†</sup>	$T_A^{\ddagger}$	LM124A			LM224A			MIN
			MIN	TYP <sup>§</sup>	MAX	MIN	TYP <sup>§</sup>	MAX	
$V_{IO}$	Input offset voltage $V_{IC} = V_{ICR\min}, V_O = 1.4\text{ V}$	25°C		2		2	2	3	
		Full range		4		4			
$I_{IO}$	Input offset current $V_O = 1.4\text{ V}$	25°C		10		2	2	15	
		Full range		30		30			
$I_{IB}$	Input bias current $V_O = 1.4\text{ V}$	25°C		-50		-15	-15	-80	
		Full range		-100		-100			
$V_{ICR}$	Common-mode input voltage range $V_{CC} = 30\text{ V}$	25°C	0 to $V_{CC} - 1.5$			0 to $V_{CC} - 1.5$			0 to $V_{CC} - 1.$
		Full range	0 to $V_{CC} - 2$			0 to $V_{CC} - 2$			0 to $V_{CC} - 2$
$V_{OH}$	High-level output voltage $R_L = 2\text{ k}\Omega$	25°C	$V_{CC} - 1.5$			$V_{CC} - 1.5$			$V_{CC} - 1.$
		$V_{CC} = 30\text{ V}$	Full range	26		26		26	
			$R_L \geq 10\text{ k}\Omega$	27		27	28	27	
$V_{OL}$	Low-level output voltage $R_L \leq 10\text{ k}\Omega$	Full range		20		5	20		
$A_{VD}$	Large-signal differential voltage amplification $R_L \geq 2\text{ k}\Omega$	25°C	50	100		50	100		25
		Full range	25			25			15
CMRR	Common-mode rejection ratio $V_{IC} = V_{ICR\min}$	25°C	70			70	80		65
KSVR	Supply-voltage rejection ratio ( $\Delta V_{CC}/\Delta V_{IO}$ )	25°C	65			65	100		65
$V_{O1}/V_{O2}$	Crosstalk attenuation $f = 1\text{ kHz to } 20\text{ kHz}$	25°C	120			120			
$I_O$	Output current $V_{CC} = 15\text{ V}, V_{ID} = 1\text{ V}, V_O = 0$	25°C	-20			-20	-30	-60	-20
		Full range	-10			-10			-10
	$V_{CC} = 15\text{ V}, V_{ID} = -1\text{ V}, V_O = 15\text{ V}$	25°C	10			10	20		10
		Full range	5			5			5
$I_{OS}$	Short-circuit output current $V_{CC} = 5\text{ V}, V_O = 0$	$V_{ID} = -1\text{ V}, V_O = 200\text{ mV}$	25°C	12		12	30		12
$I_{CC}$	Supply current (four amplifiers)	$V_O = 2.5\text{ V},$ No load	Full range	0.7	1.2		0.7	1.2	
		$V_{CC} = 30\text{ V},$ No load	Full range	1.4	3		1.4	3	

<sup>†</sup> All characteristics are measured under open-loop conditions, with zero common-mode input voltage, unless otherwise specified.

<sup>‡</sup> Full range is -55°C to 125°C for LM124A, -25°C to 85°C for LM224A, and 0°C to 70°C for LM324A.

<sup>§</sup> All typical values are at  $T_A = 25^\circ\text{C}$ .

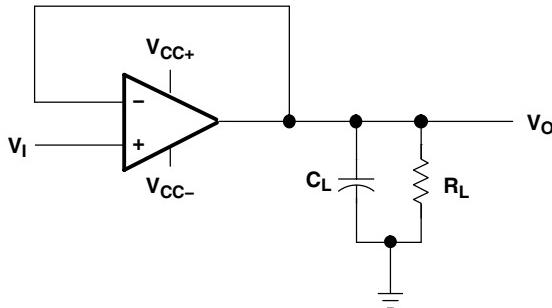
**LM124, LM124A, LM224, LM224A, LM324, LM324A, LM2902, LM2902V,  
LM224K, LM224KA, LM324K, LM324KA, LM2902K, LM2902KV, LM2902KAV  
QUADRUPLE OPERATIONAL AMPLIFIERS**

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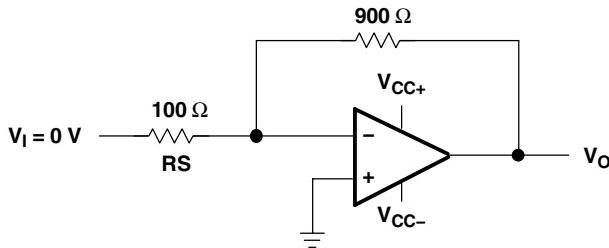
SLOS066T – SEPTEMBER 1975 – REVISED MARCH 2010

**operating conditions,  $V_{CC} = \pm 15$  V,  $T_A = 25^\circ\text{C}$**

PARAMETER	TEST CONDITIONS	TYP	UNIT
SR	$R_L = 1 \text{ M}\Omega$ , $C_L = 30 \text{ pF}$ , $V_I = \pm 10 \text{ V}$ (see Figure 1)	0.5	$\text{V}/\mu\text{s}$
$B_1$	$R_L = 1 \text{ M}\Omega$ , $C_L = 20 \text{ pF}$ (see Figure 1)	1.2	MHz
$V_n$	$R_S = 100 \text{ }\Omega$ , $V_I = 0 \text{ V}$ , $f = 1 \text{ kHz}$ (see Figure 2)	35	$\text{nV}/\sqrt{\text{Hz}}$



**Figure 1. Unity-Gain Amplifier**



**Figure 2. Noise-Test Circuit**

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**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
5962-7704301VCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
5962-9950403V9B	PREVIEW	XCEPT	KGD	14		TBD	Call TI	Call TI
5962-9950403VCA	PREVIEW			14		TBD	Call TI	Call TI
77043012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg
7704301CA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
7704301DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg
77043022A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg
7704302CA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
7704302DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg
JM38510/11005BCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
LM124ADR	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI
LM124AFKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg
LM124AJ	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
LM124AJB	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
LM124AWB	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg
LM124D	ACTIVE	SOIC	D	14	50	TBD	CU NIPDAU	Level-3-2450
LM124DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM124DR	ACTIVE	SOIC	D	14	2500	TBD	CU NIPDAU	Level-3-2450
LM124DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM124FKB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg
LM124J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
LM124JB	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg
LM124N	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
LM124W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM124WB	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg
LM224AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224DRG3	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-2600
LM224DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KAD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM224KADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KAN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224KANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224KD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KDE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KDRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM224KN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224KNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM224NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM2902D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM2902DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902DRG3	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-2600
LM2902DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KAVQDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KAVQDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KAVQPWR	ACTIVE	TSSOP	PW	14	2000	TBD	CU NIPDAU	Level-1-2500
LM2902KAVQPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDB	ACTIVE	SSOP	DB	14	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDBE4	ACTIVE	SSOP	DB	14	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDBG4	ACTIVE	SSOP	DB	14	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDBR	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDBRE4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDBRG4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM2902KDRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM2902KNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM2902KNSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KNSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KNSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KPW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KPWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KPWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KPWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KVQDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KVQDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902KVQPWR	ACTIVE	TSSOP	PW	14	2000	TBD	CU NIPDAU	Level-1-2500
LM2902KVQPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM2902NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM2902NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902PWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902PWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI
LM2902PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902PWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902PWRG3	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-2600
LM2902PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM2902QN	OBSOLETE	PDIP	N	14		TBD	Call TI	Call TI
LM324AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADBLE	OBSOLETE	SSOP	DB	14		TBD	Call TI	Call TI
LM324ADBR	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADBRE4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADB RG4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM324ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324ANSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324APW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324APWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324APWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324APWLE	OBsolete	TSSOP	PW	14		TBD	Call TI	Call TI
LM324APWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324APWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324APWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM324DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324DRG3	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-2600
LM324DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324KANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324KANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KANSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAPW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAPWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAPWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM324KAPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAPWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KAPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KDE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KDRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324KNE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324KNSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KNSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KNSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KPW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KPWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KPWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600

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PACKAG

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Pe
LM324KPWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324KPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324NE3	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU SN	N / A for Pkg
LM324NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg
LM324NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324NSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324PWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324PWLE	OBsolete	TSSOP	PW	14		TBD	Call TI	Call TI
LM324PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324PWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324PWRG3	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-2600
LM324PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-2600
LM324Y	OBsolete	DIESALE	Y	0		TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new

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PACKAG

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(<sup>2</sup>) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com> for information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants in homogeneous material)

(<sup>3</sup>) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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### **OTHER QUALIFIED VERSIONS OF LM124, LM124-SP, LM124M, LM2902 :**

- Catalog: [LM124](#), [LM124](#)
- Automotive: [LM2902-Q1](#)
- Enhanced Product: [LM2902-EP](#)
- Military: [LM124M](#), [LM124M](#)
- Space: [LM124-SP](#), [LM124-SP](#)

**NOTE: Qualified Version Definitions:**

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

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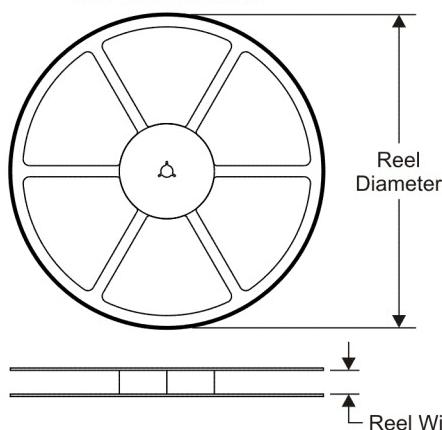
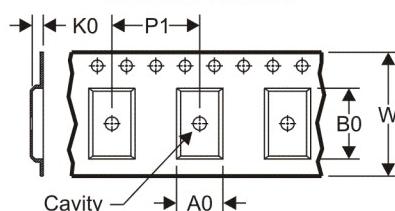
[www\(ti\).com](http://www(ti).com)

PACKAG

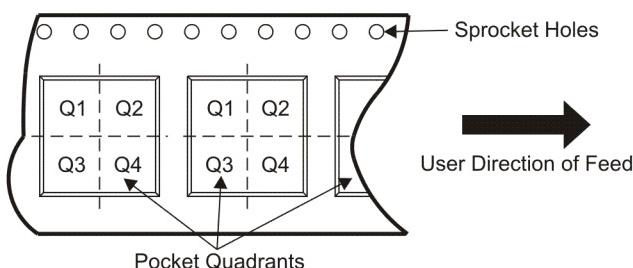
- 
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
  - Military - QML certified for Military and Defense Applications
  - Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

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5-Nov-2010

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


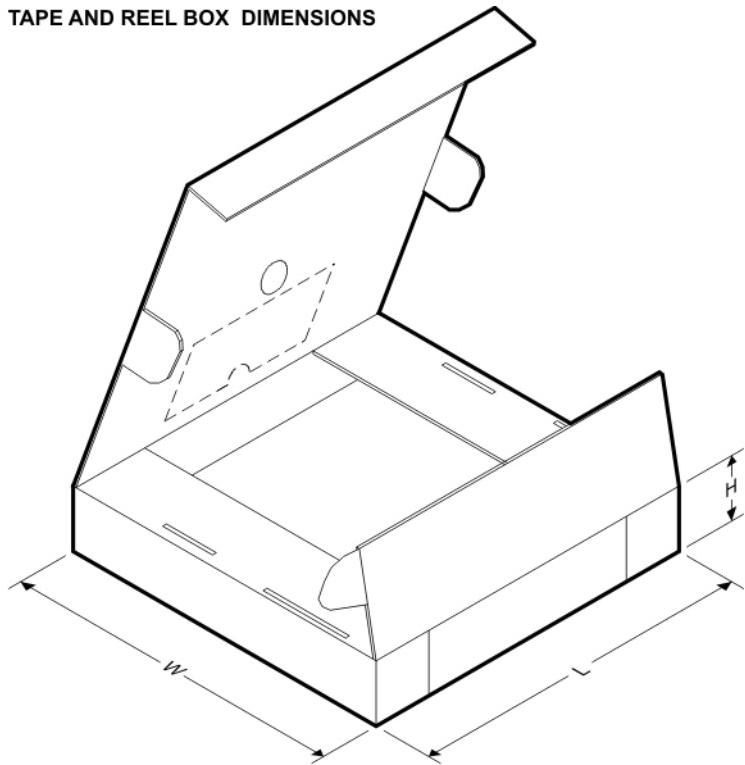
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM224ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM224ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM224DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM224KADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM224KDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM2902DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM2902DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM2902KAVQPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM2902KDBR	SSOP	DB	14	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
LM2902KDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM2902KNR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
LM2902KPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM2902KVQPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM2902NSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
LM2902PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM2902PWREG3	TSSOP	PW	14	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
LM324ADB	SSOP	DB	14	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
LM324ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM324ANSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
LM324APWR	TSSOP	PW	14	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
LM324APWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM324DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM324DR	SOIC	D	14	2500	330.0	16.4	6.55	9.05	2.1	8.0	16.0	Q1
LM324DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM324KADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM324KANSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
LM324KAPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM324KDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LM324KNSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
LM324KPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM324NSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
LM324PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LM324PWREG3	TSSOP	PW	14	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

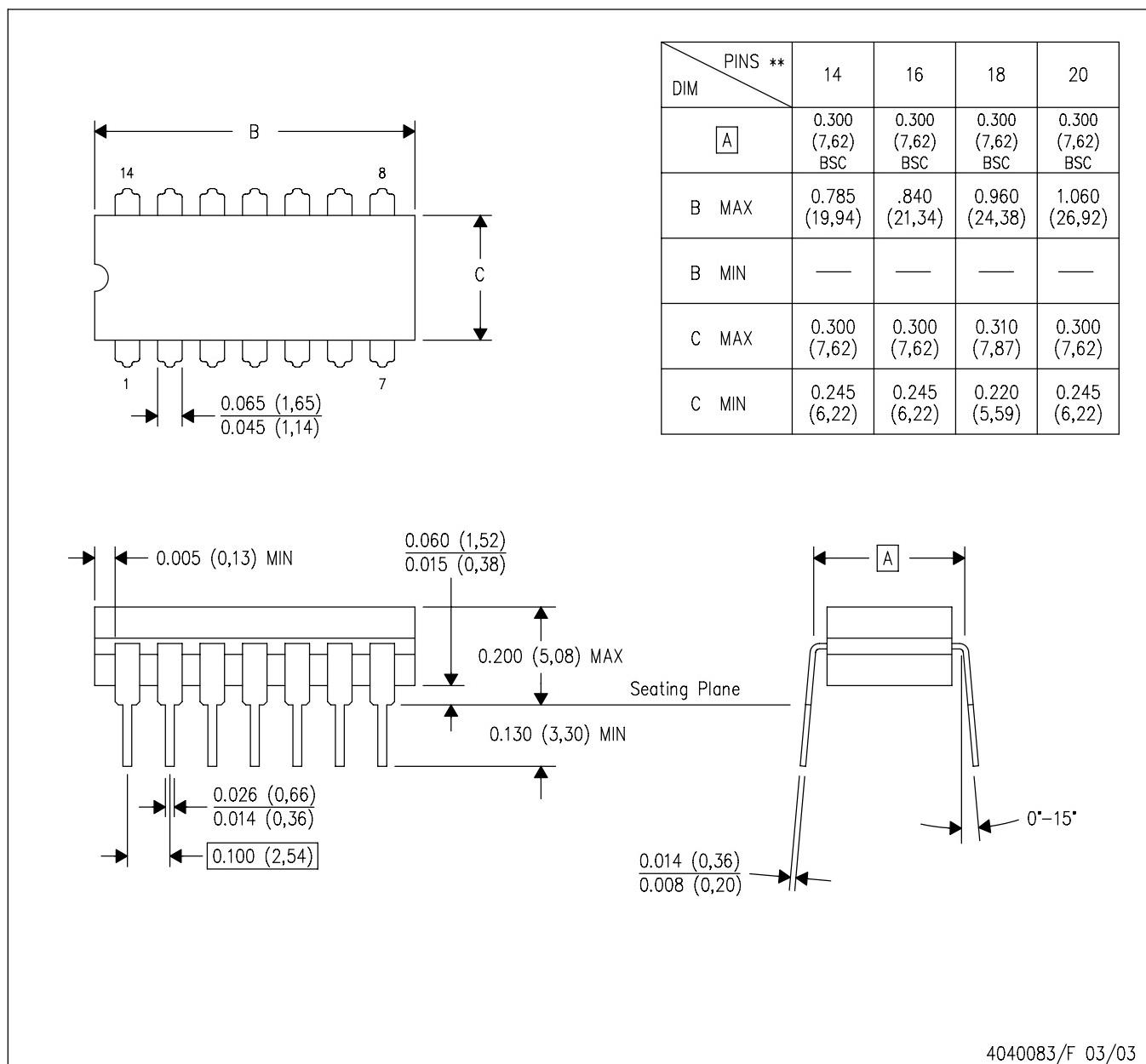
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM224ADR	SOIC	D	14	2500	346.0	346.0	33.0
LM224ADR	SOIC	D	14	2500	333.2	345.9	28.6

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM224DR	SOIC	D	14	2500	346.0	346.0	33.0
LM224KADR	SOIC	D	14	2500	346.0	346.0	33.0
LM224KDR	SOIC	D	14	2500	346.0	346.0	33.0
LM2902DR	SOIC	D	14	2500	346.0	346.0	33.0
LM2902DR	SOIC	D	14	2500	333.2	345.9	28.6
LM2902KAVQPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM2902KDBR	SSOP	DB	14	2000	346.0	346.0	33.0
LM2902KDR	SOIC	D	14	2500	346.0	346.0	33.0
LM2902KNSR	SO	NS	14	2000	346.0	346.0	33.0
LM2902KPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM2902KVQPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM2902NSR	SO	NS	14	2000	346.0	346.0	33.0
LM2902PWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM2902PWRG3	TSSOP	PW	14	2000	364.0	364.0	27.0
LM324ADBR	SSOP	DB	14	2000	346.0	346.0	33.0
LM324ADR	SOIC	D	14	2500	346.0	346.0	33.0
LM324ANSR	SO	NS	14	2000	346.0	346.0	33.0
LM324APWR	TSSOP	PW	14	2000	364.0	364.0	27.0
LM324APWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM324DR	SOIC	D	14	2500	333.2	345.9	28.6
LM324DR	SOIC	D	14	2500	385.0	388.0	194.0
LM324DR	SOIC	D	14	2500	346.0	346.0	33.0
LM324KADR	SOIC	D	14	2500	346.0	346.0	33.0
LM324KANSR	SO	NS	14	2000	346.0	346.0	33.0
LM324KAPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM324KDR	SOIC	D	14	2500	346.0	346.0	33.0
LM324KNSR	SO	NS	14	2000	346.0	346.0	33.0
LM324KPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM324NSR	SO	NS	14	2000	346.0	346.0	33.0
LM324PWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LM324PWRG3	TSSOP	PW	14	2000	364.0	364.0	27.0

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J (R-GDIP-T\*\*) CERAMIC DUAL IN-LINE PACKAGE

14 LEADS SHOWN

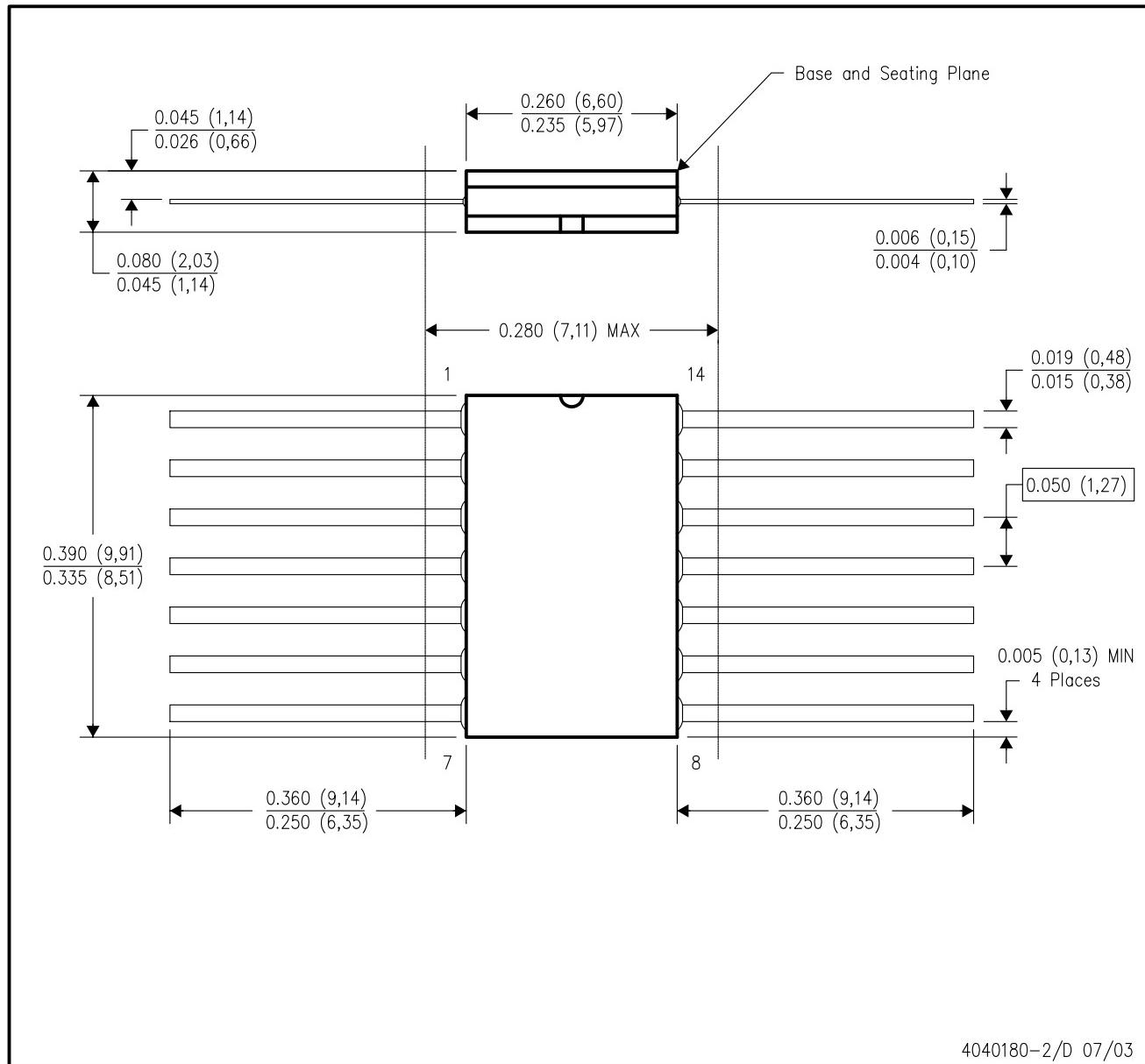


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

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## W (R-GDFP-F14)

## CERAMIC DUAL FLATPACK



4040180-2/D 07/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL-STD 1835 GDFP1-F14 and JEDEC MO-092AB

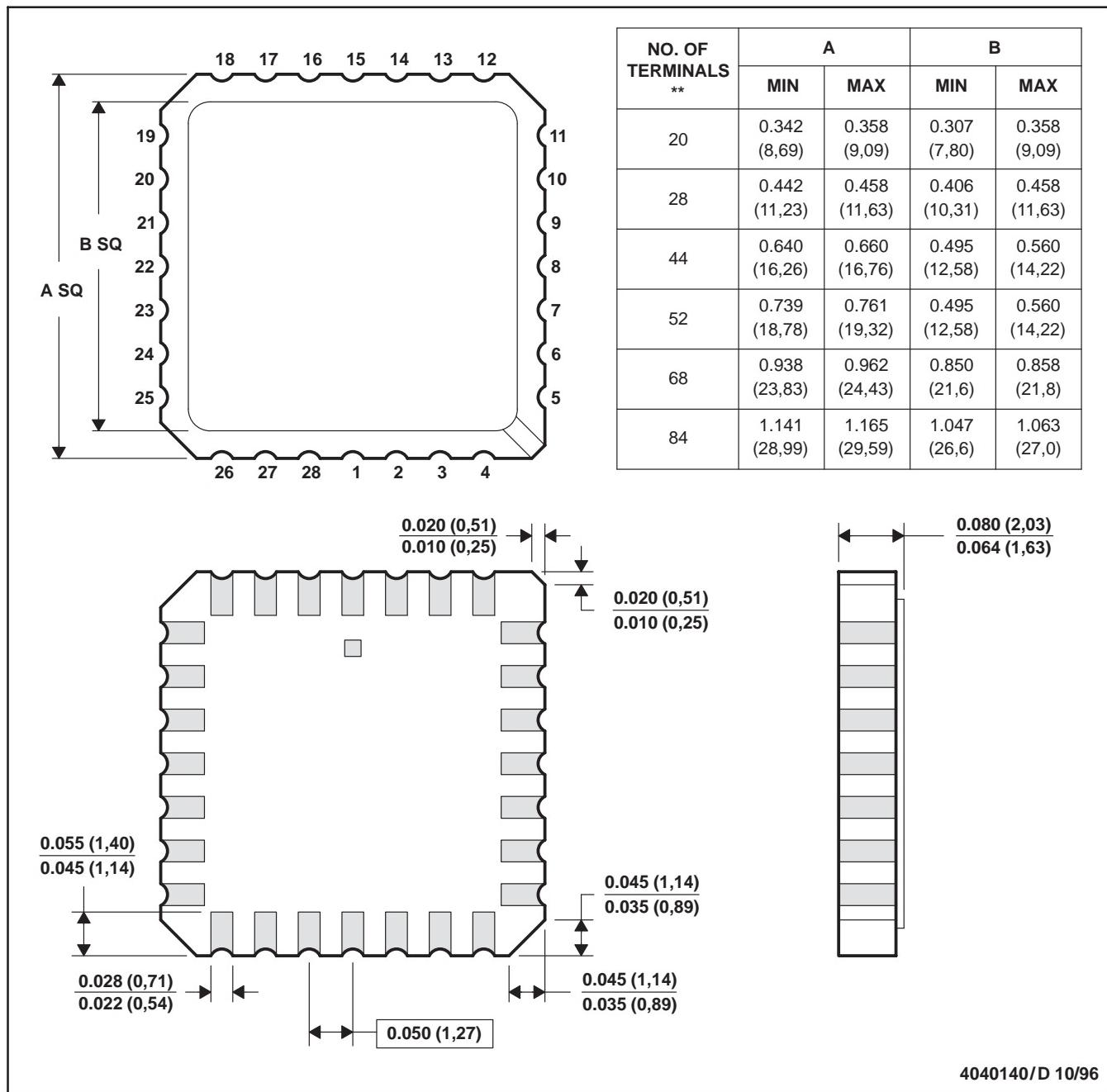
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MLCC006B – OCTOBER 1996

FK (S-CQCC-N\*\*)

28 TERMINAL SHOWN

## LEADLESS CERAMIC CHIP CARRIER



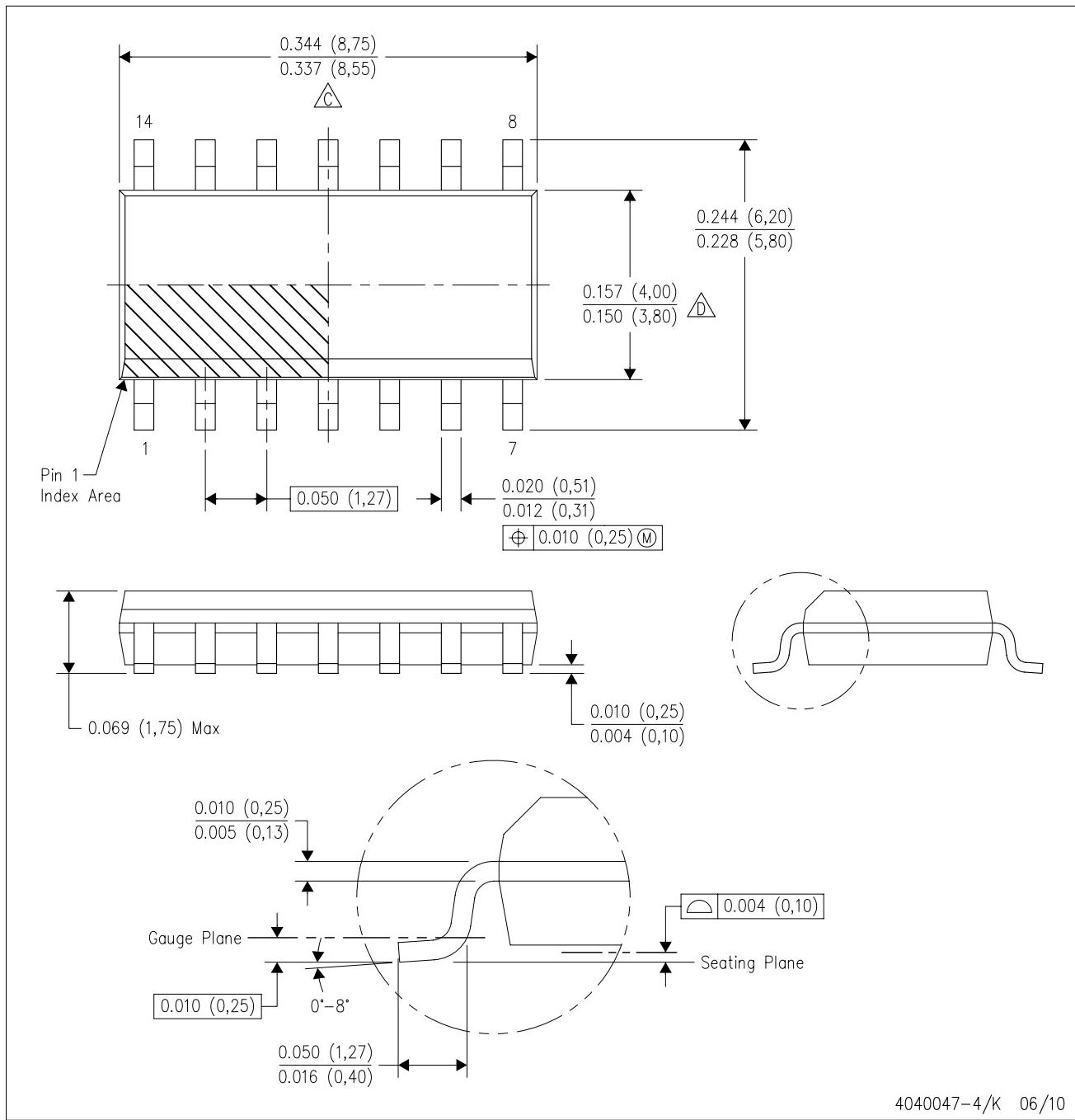
4040140/D 10/96

- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a metal lid.  
 D. The terminals are gold plated.  
 E. Falls within JEDEC MS-004

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D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.

D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.

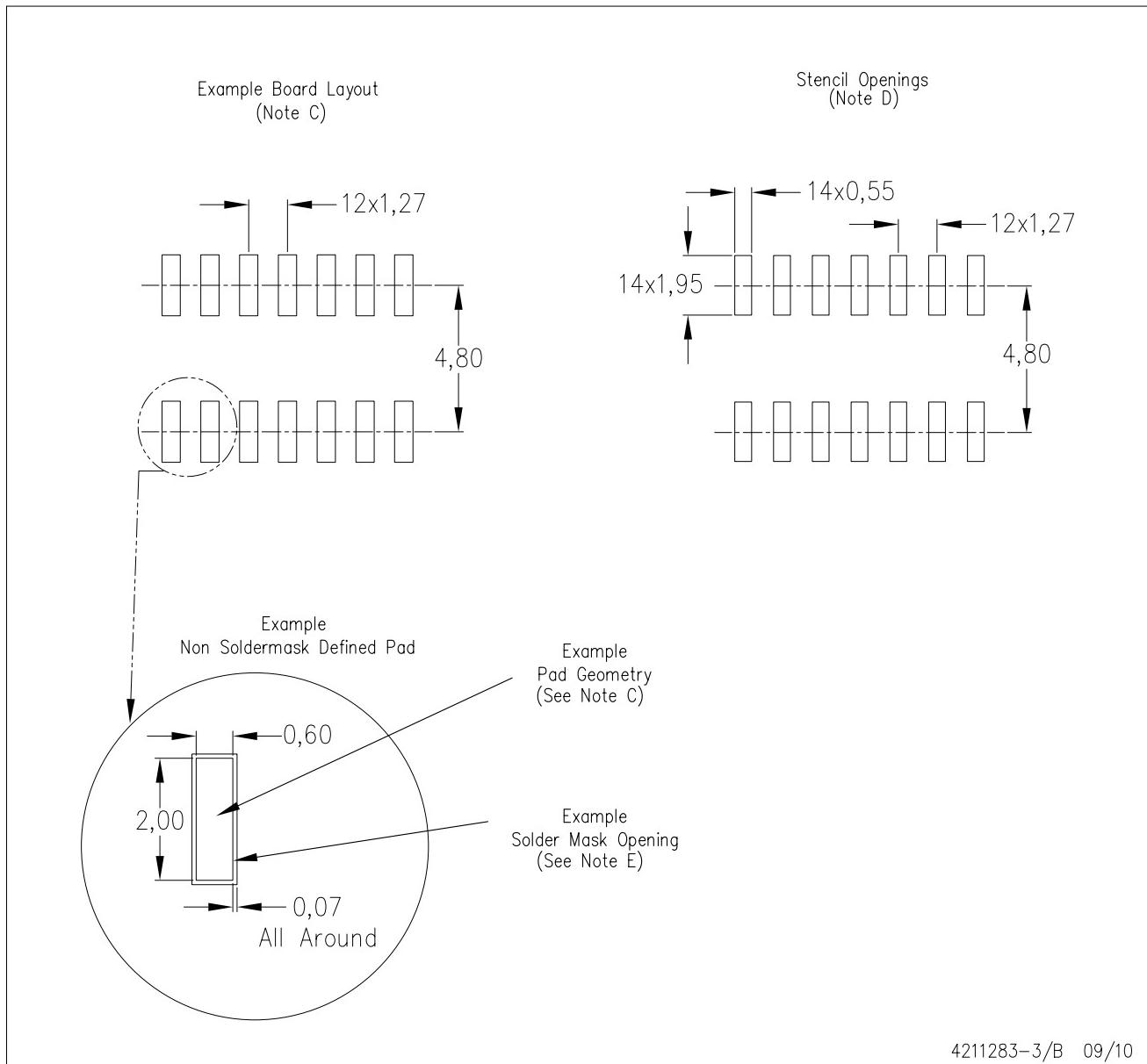
E. Reference JEDEC MS-012 variation AB.

## LAND PATTERN DATA

查询"LM124M"供应商

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

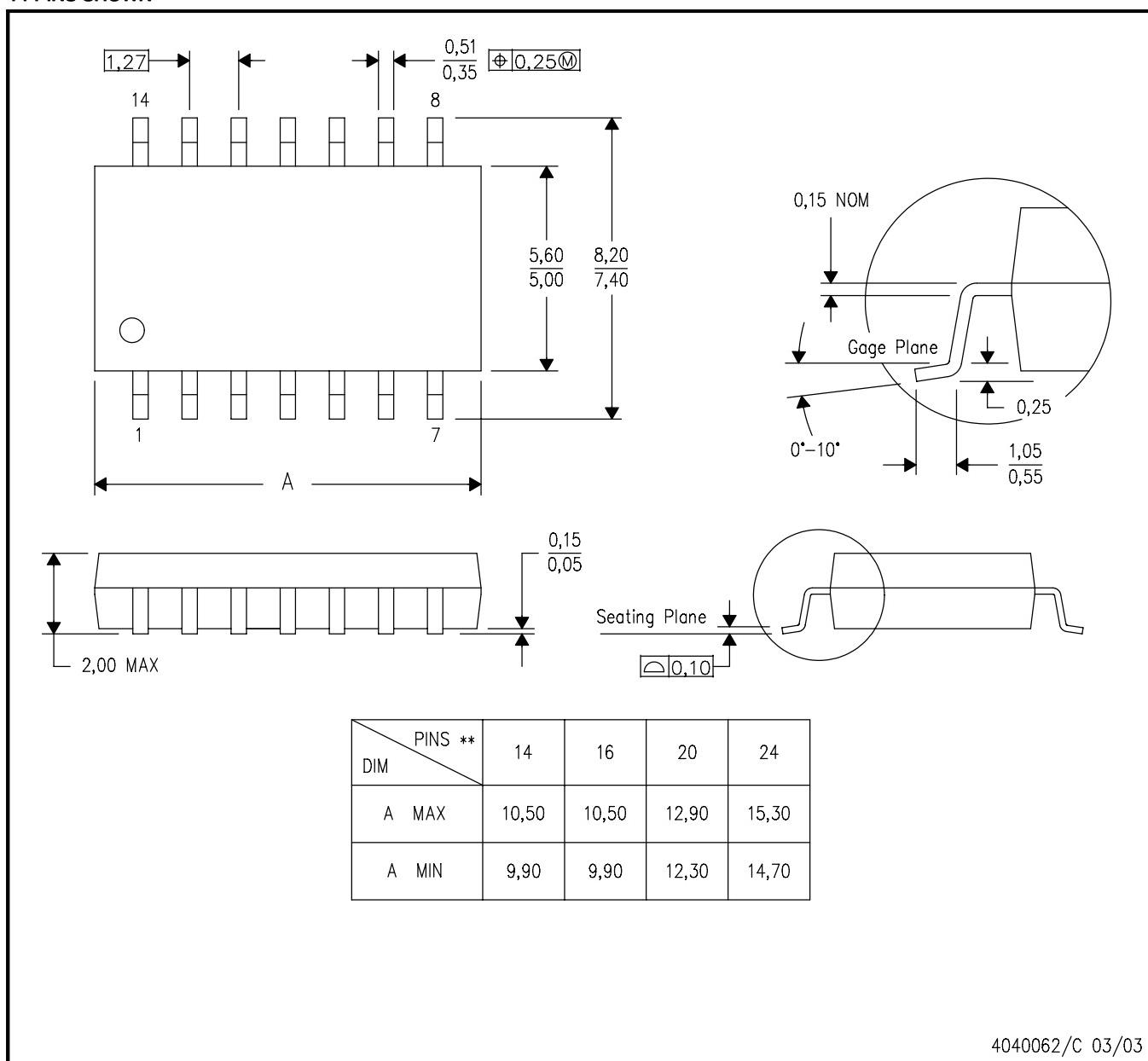
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## MECHANICAL DATA

NS (R-PDSO-G\*\*)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

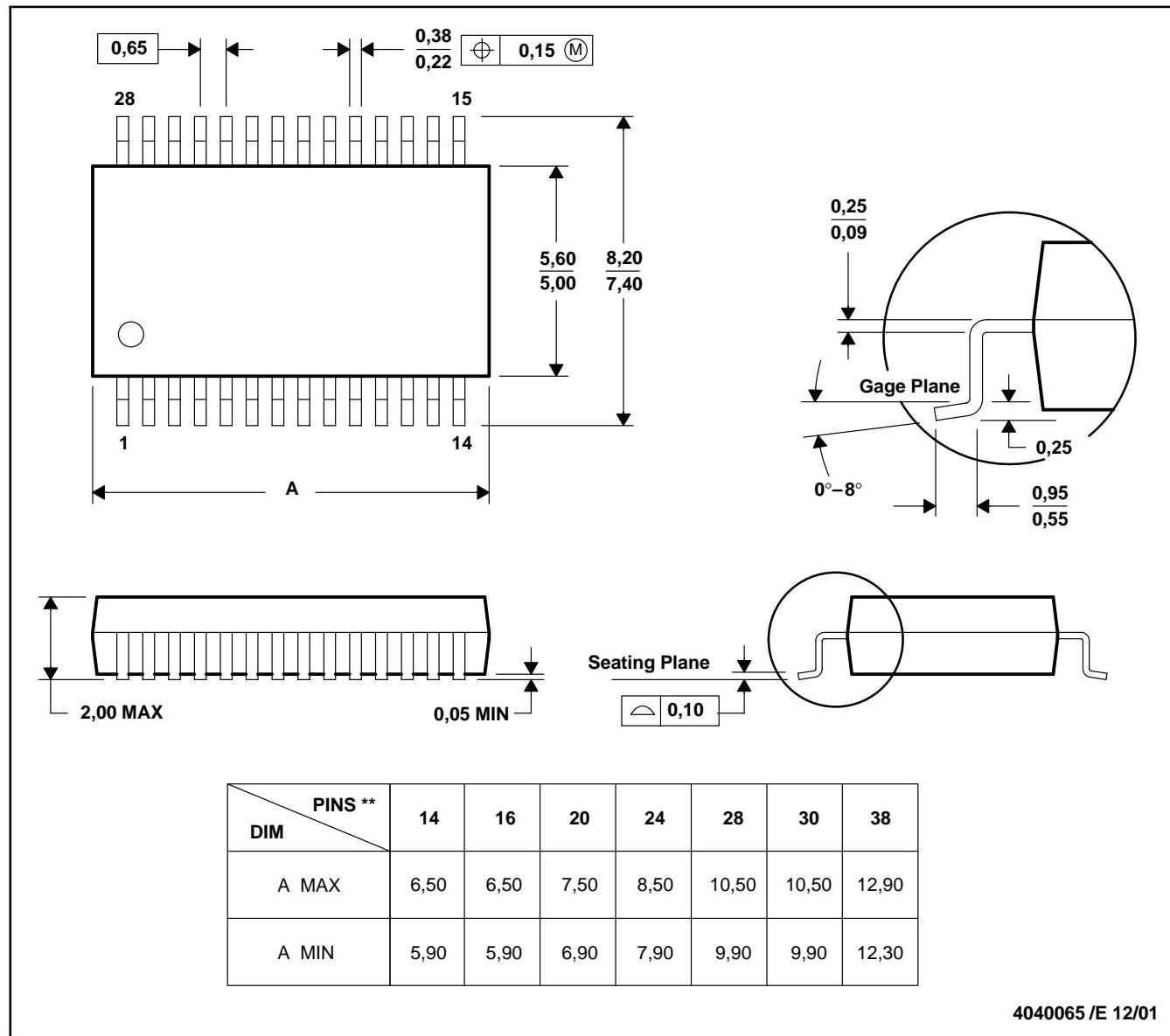
查询"LM124M"供应商

MSS002E – JANUARY 1995 – REVISED DECEMBER 2001

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

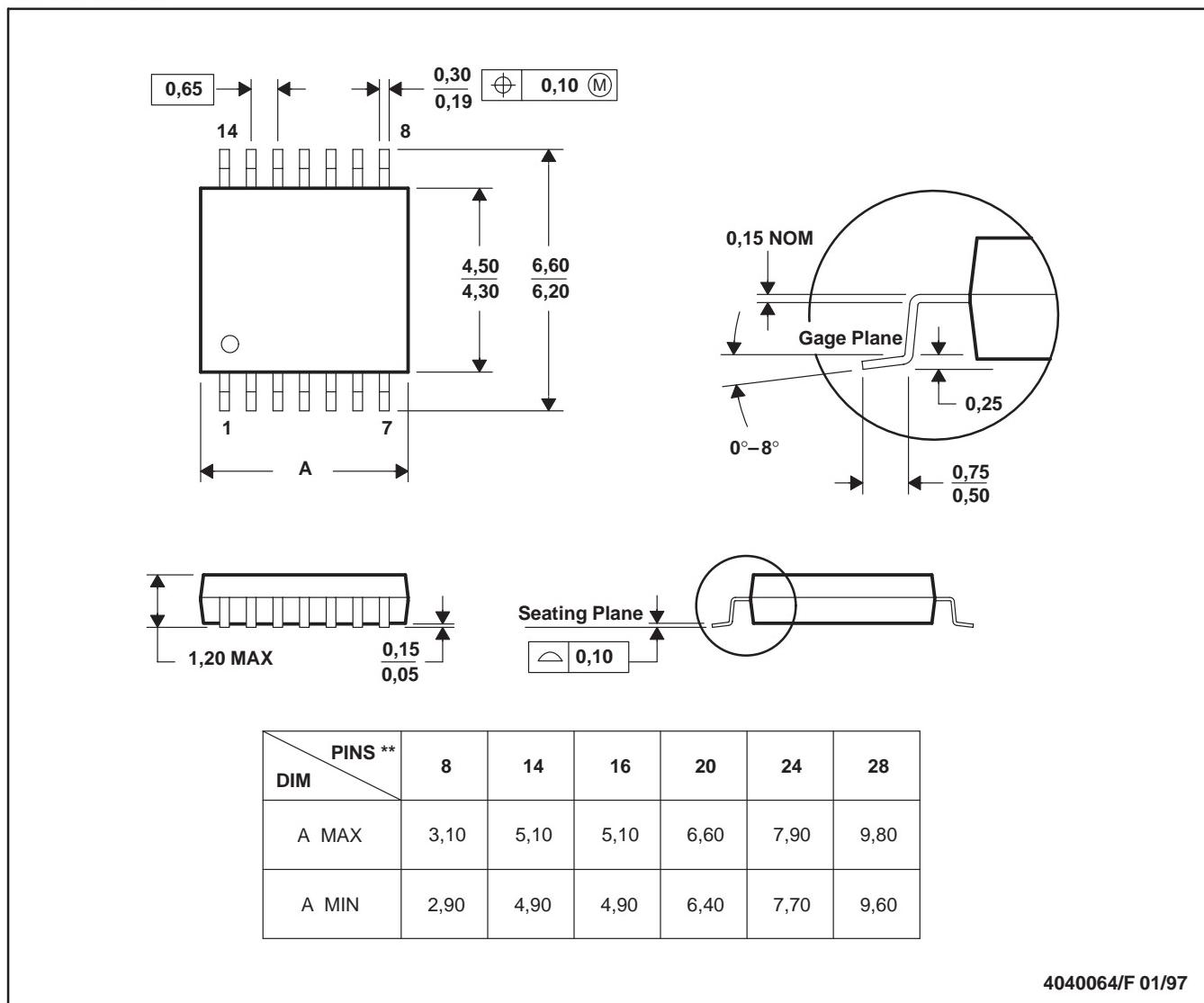
查询"LM124M"供应商

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



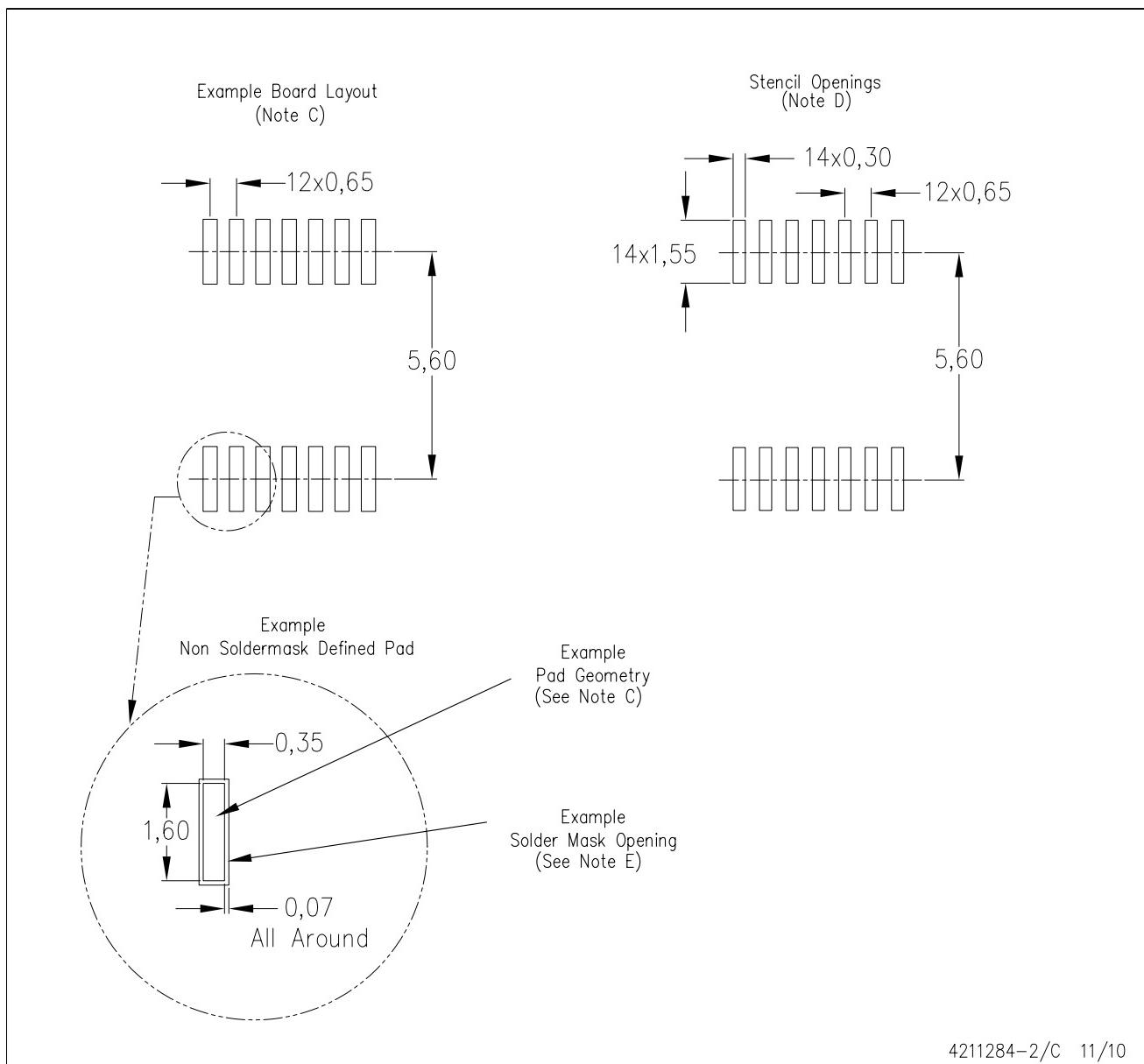
- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0,15.
  - Falls within JEDEC MO-153

## LAND PATTERN DATA

查询"LM124M"供应商

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211284-2/C 11/10

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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